

## Battery Emulator

A **battery emulator** is an electronic instrument that will simulate many real battery electrical properties and characteristics. These characteristics are power, current, voltage, ESR, etc. It supplies the needed voltage, power, and current to a handheld device similar to an actual battery does. Generally an emulator will replace the battery inside a portable device for testing purpose. The emulator empowers test engineers to easily and thoroughly test these portable systems. Thorough testing is required both for product developments and final production.

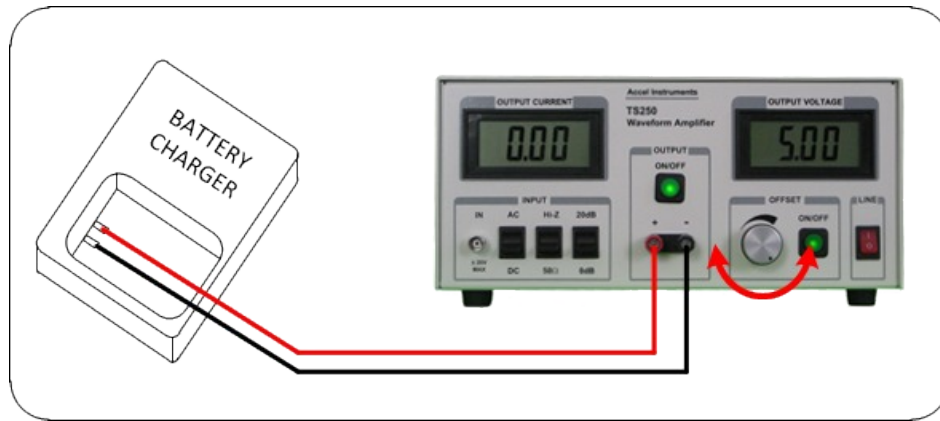


Figure 1. TS250 in emulation mode is connected to a charger for easy testing.

## Charger Testing Using Battery Emulator

Charger circuit that charges the battery is included in a lot of mobile electronic systems. The charger circuit must be fully and methodically tested to be certain it meets all of the specifications and reliably charge the batteries. A typical charging cycle is from depleted battery to fully charge typically takes few hours to complete. For that reason, charging cycle testing needs several hours. A complete charging cycle test can be done in just a few seconds when the battery is replaced with an emulator. Similarly, it could take a couple of days to empty a real battery in a portable handheld system. However an emulator can easily **simulate the battery** becoming drain within a few moments. While battery is simulated and "charging", engineers can monitor how the device and charger responds as the "battery" is depleted. A battery emulator can test these mobile devices to ensure that they met all of the specifications without waiting for hours. Furthermore, an emulator can easily simulate an overcharged battery cell as well as a completely depleted one (no voltage), both of which cases are difficult to do with an actual battery.

## Emulator for Testing Cell Balancing Circuits

Medium-powered electronics devices generally use multiple batteries connected in series for high power and voltage. These battery packs usually achieved optimal battery energy capacity by utilizing active cell balancing circuits. The balancing circuitry and the charger itself need to be properly tested. In order to efficiently and easily test the cell balancing circuit, a few emulators are needed as shown in Figure 2. Each emulator emulates a battery cell. System engineers can simulate one or more cells are “out-of-balance” to stress test how a battery-cell-balancing circuit behaves. For example engineer is able to simulate one of the cells is being overcharged and see how the balancing circuit behave. By the same token it's very quick to recreate one of the batteries is broken (low voltage) and validate the cell balancing circuit is acting properly. In short, battery emulator is an important device for testing charger and cell balancing circuits in mobile systems.

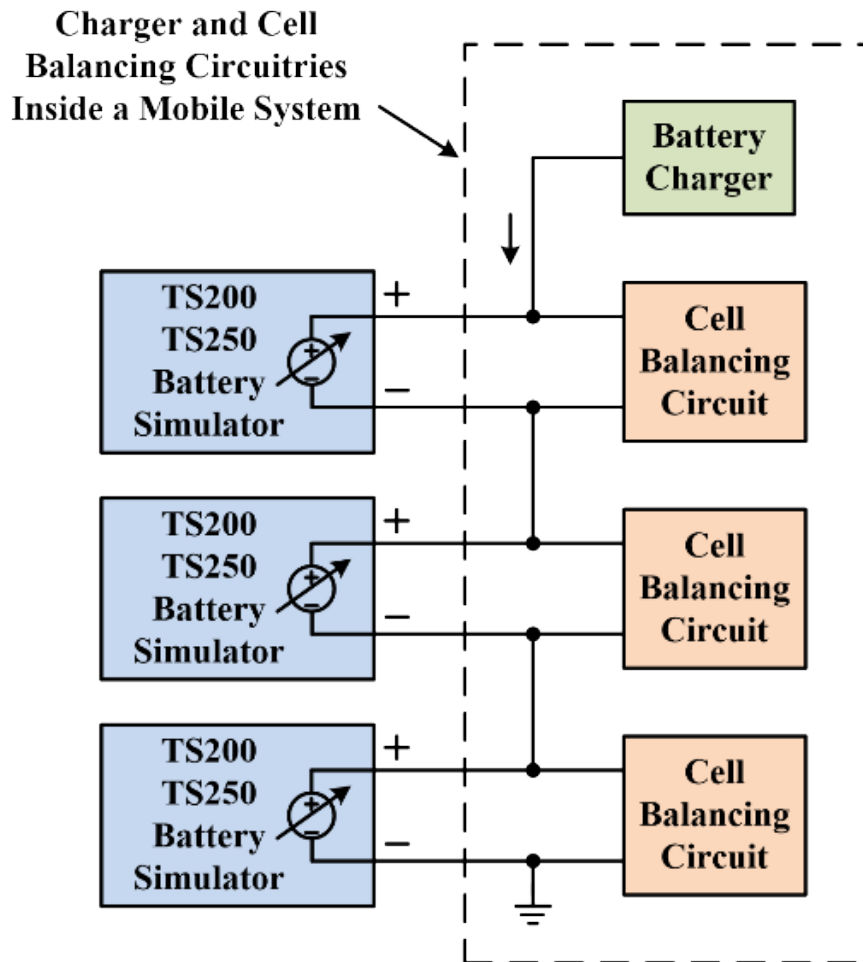


Figure 2. Multiple emulators are used to emulate a battery pack to test cell balancing circuits.

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## Emulator vs. Simulator

The terms battery emulator and battery simulator has been used in the electronic engineering industry and academic. However, there is no distinction between the two. They both perform the same function of emulating a battery. Some people preferred to call it simulator while others named it emulator. Their purpose is to replace an actual battery for the convenience of testing. The terms emulator and battery simulator are interchangeable.

## TS250/TS200 Battery Emulators

The TS200 and TS250 are high output current power supply and amplifier that can source and sink current the same way a real battery does. Thus they are battery emulators. They have a DC OFFSET control knob that can adjust the voltage to simulate battery voltage changes. Additionally the TS250 features current monitor LCD display that monitors the emulated battery current.